भारतीय मानक **IS 15475 (Part 6) : 2022**

Indian Standard

मनोरंजन के लिए सुरक्षित सवारी की संस्तुत रीति संहिता

भाग 6 कार्यकारिता परीक्षण

(पहला पुनरीक्षण)

Code of Recommended Practice for Amusement Rides Safety

Part 6 Performance Tests

(First Revision)

ICS 97.200.40

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Continuous Bulk Conveying, Elevating, Hoisting Aerial Ropeways and Related Equipment Sectional Committee, MED 6

FOREWORD

This Indian Standard (Part 6) was adopted by the Bureau of Indian Standards, after the draft finalized by the Continuous Bulk Conveying, Elevating, Hoisting, Aerial Ropeways and Related Equipment Sectional Committee had been approved by the Mechanical Engineering Division Council.

Amusement parks in India are becoming quite common and people visit these parks quite often. In order to ensure their safety in amusement parks or while enjoying the rides, an attempt has been made to stipulate safety in the form of a National Code. It is hoped that organizers of amusement parks, manufacturers of rides would make use of these codes to ensure the overall safety of human beings and equipment at such places.

This revision has been taken up to keep pace with the latest technological developments and international practices. This revision incorporates the following major changes :

a) Clause **4** and **5** were modified.

The code of recommended practice for amusement rides safety is in six parts. This standard covers the necessary performance tests for amusement rides. Other parts in this series under the general title are as follows :

Part 1 General information

Part 2 Safety requirements

Part 3 Design, manufacture, and erection

Part 4 Selection training and supervision of operators

Part 5 Operation and maintenance procedures

The composition of the committee responsible for the formulation of this standard is given in Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values’ (*second revision*). The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

CODE OF RECOMMENDED PRACTICE FOR AMUSEMENT RIDES SAFETY

PART 6 PERFORMANCE TESTS

(*First Revision*)

1 SCOPE

This standard (Part 6) covers the basic tests which shall be conducted on amusement rides or devices during prototype development, installation or erection, major modifications, and normal operation to determine that the performance of the ride or device meets the specified design criteria and requirements.

This standard is intended for use of manufacturers, owners/operators, and those persons or agencies involved in the installation and operational testing of amusement rides and devices.

This standard does not purport to cover all the safety concerns associated with its use.

This code is not intended to contravene the provision of any of the existing Government regulations. It is the responsibility of the user of this code to establish appropriate safety and health practices and comply with regulatory and statutory requirements prior to the use of the ride or device for carrying passengers for their amusement.

2 REFERENCES

The following standards contain provisions which through reference in this text, constitute the provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below :

IS No.	*Title*
2026 (Part 3) : 2018	Power transformers : Part 3 insulation levels, dielectric tests and external clearances in air (*fourth revision*)
10724 : 1990	Acceptance standard for magnetic particle testing of steel castings (*first revision*)
12938 : 1990	Acceptance standards for radiographic inspection of steel castings
IS 13805 : 2004	General standard for qualification and certification of non-Destructive testing personnel — Specification (*first revision*)
15475(Part 1) : 2022	Code of recommended practice for amusement rides safety — Part 1 General information
15475 (Part 5) : 2022	Code of recommended practice for amusement rides safety — Part 5 Operation and maintenance procedures
IS/IEC 62305-3 : 2010	Protection against lightning — Part 3 physical damage to structures and life hazard

3 TERMINOLOGY

3.1 For the purpose of this standard the following definitions, in addition to those given in IS 15475 (Part 1) shall apply.

3.1.1 *Installation or Erection* — The actual work at site relating to construction or the physical setting up and making ready for use of a ride or device.

3.1.2 *Major Modification* — Any change in either the structural or operational characteristics of the ride, which will alter its performance from that specified in the manufacturer's design criteria.

3.1.3 *Prototype* — Final operational assembly of a newly developed ride or device.

4 DEVELOPMENTAL TESTING AT MANUFACTURER'S WORKS

4.1 Manufacturer or designer shall develop test procedures and arrange testing facilities for conducting various tests on a prototype amusement ride or device in order to determine appropriateness for use of an entire system of ride or device including its major parts.

4.2 Following design parameters shall be determined or evaluated during testing at the manufacturer's end:

a) Safe design load/forces;
b) Relevant deflections caused by various motions or application of designed load;
c) Operational limits in various conditions including environmental;
d) Start and restart criteria in various conditions, such as no-load, load, overload, etc, to determine operational limits and restrictions;
e) Component variability; and
f) Material and weld tests.

4.3 The amusement ride shall be examined by the Ride Inspector upon completion of the installation works and thereafter regularly at a frequency not less than once every 12 months. The examination shall cover the structure, electrical and mechanical systems, control and safety systems, and all other systems which may affect the integrity and safe operation of the ride. The following tests and verifications, as appropriate, shall be included in the examination:

a) Overall inspection with regard to proper manufacture and installation as specified in the design documents and this Code;
b) Conformity of the main dimensions, safety envelopes, and clearances necessary for the safe and free running of moving parts;
c) Functional tests of the control system and protective devices;
d) Checking and measurement of the performance of brakes and safety-criticals ystems in normal and emergency conditions;
e) Testing of the pneumatic and hydraulic systems;
f) Electrical tests;
g) Non-destructive tests for welds and structural works;
h) Checking and measurement of the performance of the ride under full load and unbalanced load in all operating conditions;
j) Measurement of speeds, accelerations, and/or for a customs check against the design.

4.4 Performance Tests

After installation/erection of complete prototype amusement ride or device, the following operational characteristics shall be verified and compared with test records of manufacturer/designer.

a) Motion/travel (circular, vertical, horizontal or inclined);
b) Operational limits;
c) Forces or dynamic effect on passenger(s);
d) Maximum exposure time per element of ride or device/ride duration;
e) Reaction of the ride structure to collision with buffers/performance of special devices provided for buffering.

5 INSTALLATION TESTING AT USERS/ OWNER SITE

5.1 After installation of an amusement ride or amusement device all the tests conducted at manufacturers works shall be conducted and compared with the test results to determine that the newly installed ride or device conforms to the original design criteria.

5.1.1 Test results and observations shall be comparable within acceptable limits.

5.2 All the recommended tests relevant to the installation shall be conducted on the basis of acceptance test procedures. In addition to tests in **5.1**, additional tests relevant to the installation shall be conducted but shall not be limited as follows :

5.2.1 Acceptance testing of major structural components.

5.2.2 Acceptance testing of construction operations such as welding and fastening as per appropriate code of practice.

5.2.3 *Performance Testing*

Series of specified tests that can be the basis to determine that the new installed ride or device is safe for carrying passengers for amusement purposes and also meets the original design criteria.

5.3 Endurance Test

Each amusement ride or amusement device shall be operated for a fixed number of operating cycles as agreed between the manufacturer and owner/user in order to determine the stability and capability of the ride or device during expected or declared service life.

5.4 Full Load Test

This shall be carried out by operating the ride at the nominal speed and under the designed service conditions, with equivalent dummy loads placed on the passenger units. Continuous running of the ride at full load for a prolonged period may be required to verify the reliability of the ride.

5.5 Unbalanced Load Test

This test shall be carried out with the configurations specified by the manufacturer or decided by the surveyor. Such configurations shall be properly documented. The Surveyor shall not proceed with the unbalanced load test if there is any adverse vibration, harmonic oscillation, or abnormal movement of the ride or its foundation/footing.

5.6 Continuity of Protective Conductors

Every protective conductor, including all conductors and any extraneous conductive parts used for equipotential bonding, shall be tested for continuity.

5.7 Insulation Resistance

The insulation resistance of the electrical works shall be measured and shall be not less than the following values when tested with a 1 000 V insulation tester.

a) Insulation resistance to the earth 1 MΩ
b) Insulation resistance between poles or phase 1 MΩ
c) Insulation resistance of equipment 0.5 MΩ

5.8 Verification of Polarity

A test of polarity shall be carried out to verify that

a) Every fuse and single-pole control and the protective device is connected in the phase conductor only;
b) Center-contact bayonet and Edison-type screw lamp holders in circuits having an earthed neutral conductor, have their outer or screwed contacts connected to that neutral conductor; and
c) Wiring works are sound and correctly connected.

5.9 Tests for Hydraulic and Pneumatic System

The following basic items, which are pertinent to the typical hydraulic and pneumatic system, shall be checked and attended to.

a) Ram and cylinder condition;
b) Levelling switches;
c) Pipeworks, joints, bolts, and fixings; stop valve; oil reservoir; pump and motor;
d) Control valves, pilot and leveling valves; overrun and cut-off devices; overload relief valve;
e) Air release cock and anti-siphon valve;
f) Pressure vessel.

Besides, the following tests shall be carried out to establish the integrity of a hydraulic or pneumatic system and its components as per the designer or manufacturer's specifications.

a) Functional test to ascertain the correct operation of the system and all safety devices;
b) Pressure tests to every part of the hydraulic or pneumatic system at the maximum working pressure sustained under all conditions of intended use.

5.10 Earth Fault Loop Impedance and Earth Electrode Resistance

A test shall be carried out to verify the effectiveness of the earthing by means of a phase-earth loop tester. The impedance for each loop shall not exceed the requirements as stipulated in IS 2026 (Part 3).

5.11 Functions of Protective Devices

Every residual current device shall be tested with a residual current device tester simulating an earth fault or other methods complying with relevant standards.

Air circuit breakers, molded case circuit breakers, miniature circuit breakers, isolators, switches, and indicative devices should be checked by hand operation.

Overload and fault current protection characteristics of protective relays shall be verified with a second injection test.

5.12 Lightning Protection System

For outdoor amusement rides involving tall and massive structures, an assessment of the risk of being struck by lightning shall be made as per IS/IEC 62305-3.

6 APPROVAL OF REGULATORY/ STATUTORY AUTHORITY PRIOR TO USE

6.1 The manufacturer/designer shall obtain the approval of competent authority if required for use of an amusement ride or an amusement device for carrying a passenger for amusement purposes.

6.1.1 Necessary license or approval of competent authority obtained shall be provided to the owner/ purchaser/user of ride or device, if applicable.

6.2 The operator on erection/installation and conducting the performance tests shall request the inspecting or statutory authority to verify the performance tests and other safety requirements necessary for use of ride or device for the purpose intended.

6.2.1 The operator of the ride or device shall also arrange the testing facility required during periodic inspections of statutory/regulatory authority if required.

7 CHARACTERISTICS OF PERFORMANCE TESTS DURING NORMAL OPERATION

7.1 The manufacturer/designer of the ride shall recommend performing all those tests that have been satisfactorily conducted by them prior to sale.

7.1.1 Frequency/interval for the above tests shall also be stated by the manufacturer/designer.

7.1.2 Test results of all the developmental tests conducted by the manufacturer shall be the basis for comparison within the allowed tolerances limits.

7.2 Performance tests to be conducted during normal operation shall be such that amusement ride, device, or element can reasonably expect to pass during the declared design life, assuming that the recommended operation and maintenance procedures as specified in IS 15475 (Part 5) shall be followed.

7.3 All tests shall be reasonable and the operator can perform these tests with the help of qualified/trained personnel or a testing agency.

7.4 Any operational test including load testing performed on an amusement ride, device, or element shall be completely non-destructive in nature. Overload testing exceeding the safe limits shall not be allowed to be performed.

7.5 Any installation or operation testing conducted on ride, device, or element shall be accomplished within the rated limits as recommended by the manufacturer.

8 NON-DESTRUCTIVE TESTING (NDT)

8.1 Non-destructive testing shall be used to verify the integrity of the components which cannot be evaluated by other conventional test methods due to their design, location, or installation.

8.2 Non-destructive testing shall be performed by qualified NDT personnel. For guidance IS 13805 may be referred.

8.3 The manufacturer shall recommend components to be tested and acceptance criteria shall also be specified. For guidance IS 10724 and IS 12938 may be referred.

8.4 NDT schedule shall be defined in terms of hours or days or other units of operations.

8.5 Components found to have relevant indications of the defect, imperfection or discontinuities shall be replaced or reconditioned.

8.5.1 Integrity of the reconditioned components shall be further tested to determine the usefulness or serviceability of the component.

8.6 All the test results or observations shall be recorded and compared with the earlier results/observations.

8.7 The manufacturer/designer may recommend the NDT method where certain test methods may endanger other components on the ride or device.

ANNEX A

(*Foreword*)

COMMITTEE COMPOSITION

Continuous Bulk Conveying, Elevating, Hoisting Aerial Ropeways and Related Equipment Sectional Committee, MED 06

Organization	*Representative(s)*
RITES Limited, Gurugram	Shri Sandeep Mehra (***Chairman***)
CSIR — Central Institute for Mining and Fuel Research, Dhanbad	Shri Debashish Basak Shri Girendra M. Prasad (*Alternate*)
Conveyor and Ropeway Services Private Limited, Kolkata	Shri S. Shekhar Chkravarty Shri Kamal Kumar Bose (*Alternate*)
Desein Private Limited, New Delhi	Shri H. K. Gupta Shri Arvinder Singh (*Alternate*)
Directorate General Factory Advice Service and Labour Institutes, Mumbai	Shri G. P. Nijalingappa Shri H M Bhandari (*Alternate*)
Directorate General of Mines Safety, Dhanba	Shri D. B. Nayak Shri Vijay Yadaorao Barapatre (*Alternate*)
Durgapur Steel Plant, Sail Durgapur	Shri Sanjay Kumar Shri Deepak Biswal (*Alternate*)
Elecon Engineering Company Limited, Gujarat	Shri C. S. Shah Shri K. S. Kodia (*Alternate*)
Indian Association of Amusement Parks and Industries, Mumbai	Shri Pradeep Sharma Shri Anil Padwal (*Alternate*)
Lepton Projects Private Limited, Ghaziabad	Shri Sanjay Kumar Shri Piyush Rathi (*Alternate*)
MECON Limited, Ranchi	Shri Sanjoy Bhattachar Shri Amit Pal (*Alternate*)
Mcnally Bharat Engineering Company Limited, Kolkata	Shri Sanjoy Maiti Shri Sandipan Daw (*Alternate*)
Ministry of Ports, Shipping and Waterways, New Delhi	Shri Anil Pruthi Shri Ramji Singh (*Alternate*)
NTPC Limited, New Delhi	Shri O. P. Kalia
National Mineral Development Corporation, Hyderabad	Shri Alok Kumar Mehta Shri S. Surender (*Alternate*)
Phoenix Conveyor Belt India Private Limited, Kolkata	Shri Rajeev Sharma Shri Asoke Kum. Ghosh (*Alternate*)
Polo Amusement Park Lmited, Gurugram	Shri Santosh Chawla
Project and Development India Limited, Noida	Shri Narendra Singh
RITES Limited, Gurugram	Shri Dinesh Kumar

Organization	*Representative(s)*
Ropeway and Resorts Private Limited, Kolkata	SHRI A.K. KINRA
TRF Limited (A Tata Enterprise), Jamshedpur	SHRI N. K. SINGH SHRI SUBHASH SHARMA (*Alternate*)
Tata Consulting Engineers Limited, Navi Mumbai	SHRI SUJOY MAITI SHRI SHIREESH S. SWAMI (*Alternate*)
Usha Breco Limited, Ghaziabad	SHRI MANOJ PANWAR SHRI SANJEEV DHARIWAL (*Alternate*)
Usha Martin Limited, Ranchi	SHRI SUBRATA DUTTA SHRI SANDEEP JAISWAL (*Alternate*)
In personal capacity (*145/4A, South Sinthi Road, Kolkata – 700050*)	SHRI C. K. KARMAKAR
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In personal capacity (*F-7B DDA MIG Flats, Hari Nagar, New Delhi - 110006*)	SHRI S. C. GANDHI
In personal capacity (*20 D, Dhakuria Station Road, Kolkata - 700031*)	SHRI RANJAN MUKHERJEE
BIS Directorate General	SHRI RAJNEESH KHOSLA, SCIENTIST 'E' AND HEAD (MED) [REPRESENTING DIRECTOR GENERAL (*Ex-Officio*)]

Member Secretary
SHRI AMAN DHANAWAT
Scientist 'B' (MED), BIS

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